



**POWERMAX<sup>®</sup>** ['pou (ə)r 'maks] *noun*:  
a system designed to maintain stability

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# Agenda

- POWERMAX – Power Management System Introduction
- POWERMAX – Functionalities (IDDS, LSP, GCS, A25A)
- POWERMAX – Simulators
- MOTORMAX – LV Motor Management System Introduction

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INTRODUCTION

# POWERMAX Simulators

- Static simulator
- Simulator with load flow
- Simulator with playback
- Dynamic simulator (RTDS)

It is recommend to at least perform  
a static simulator with load flow

# PMS Simulator Rack

Main HMI Screen

Main HMI

LSP A

LSP B



Simulator HMI Screen

Simulator HMI

Simulator Platform

# Real Time Digital Simulator (RTDS)

- Electromagnetic Transients Program (EMTP) simulator
- Advanced parallel processing techniques
- Power system state calculation every  $50 \mu\text{s}$
- Ability to perform closed-loop testing with physical protection and control devices in real-time

# System Modeling and Testing Services

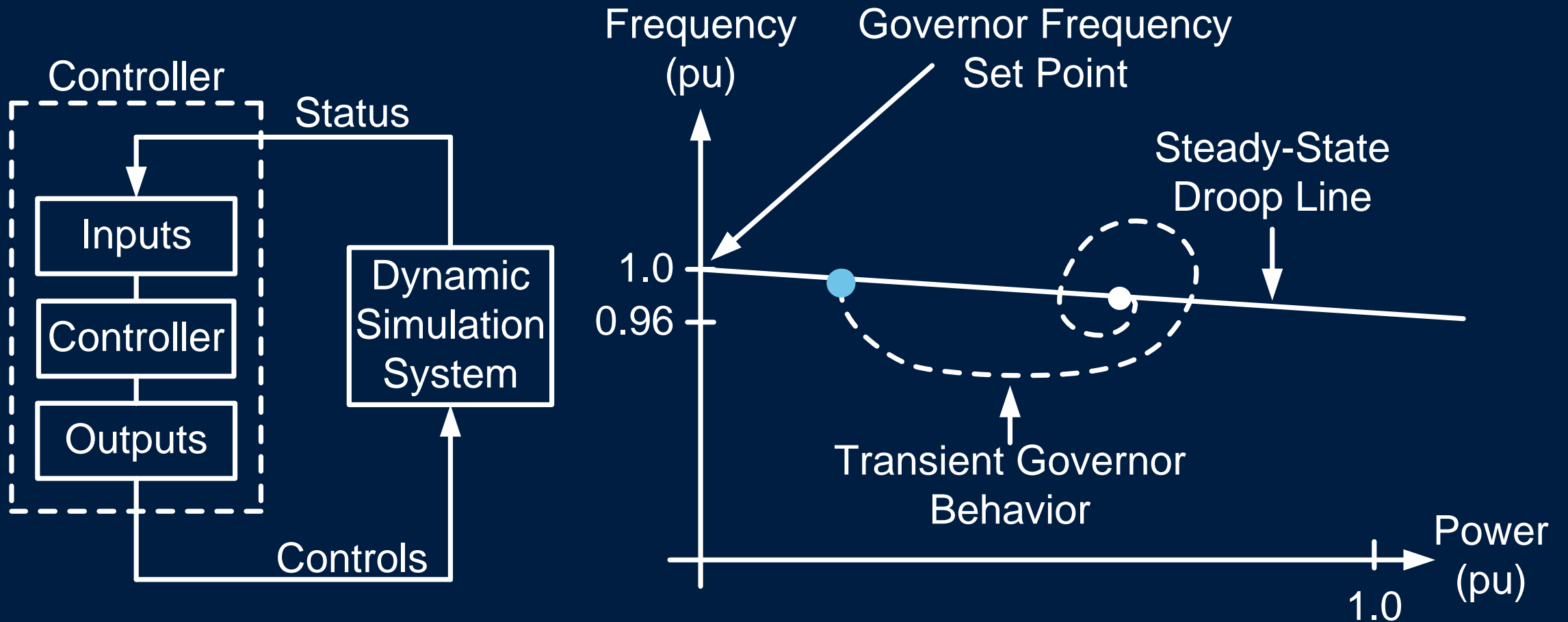
- Power system model development
- Load flow and short-circuit analysis
- Harmonic analysis
- Coordination studies
- Reports
- System protection scheme design, setting, and validation
- Inrush studies
- Frequency and voltage stability analysis

# Dynamic Simulations Using Real-Time Simulator

- Combines detailed system model with real-time closed-loop testing
- Validates schemes' functionality for speed and reliability
- Optimizes thresholds through test case iteration
- Improves understanding of system dynamics

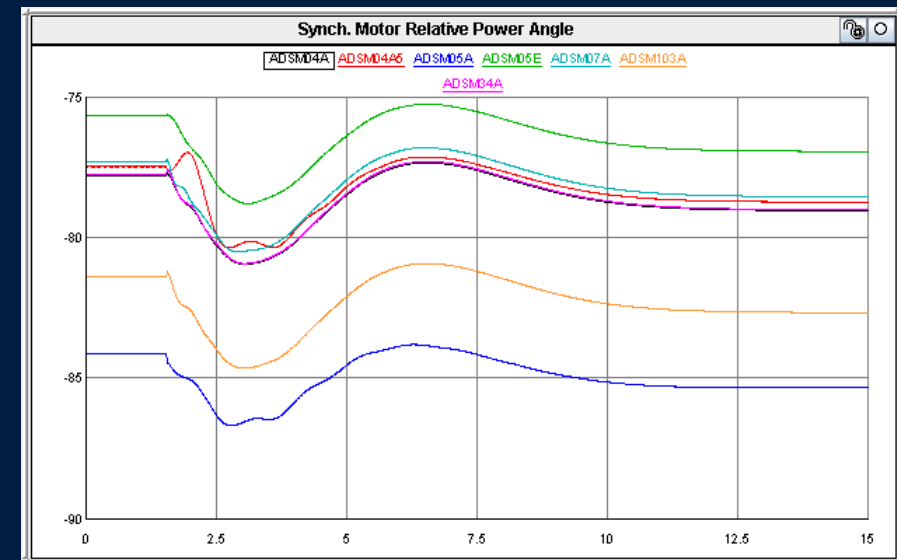
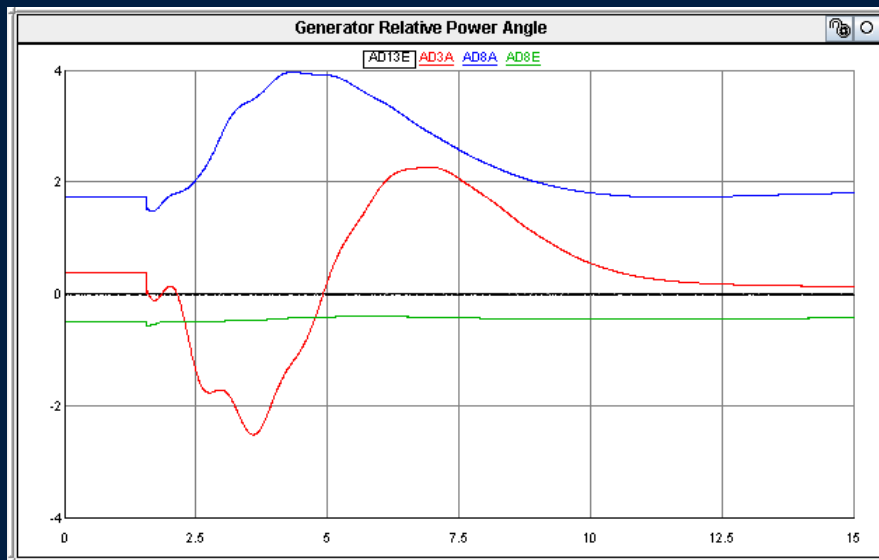
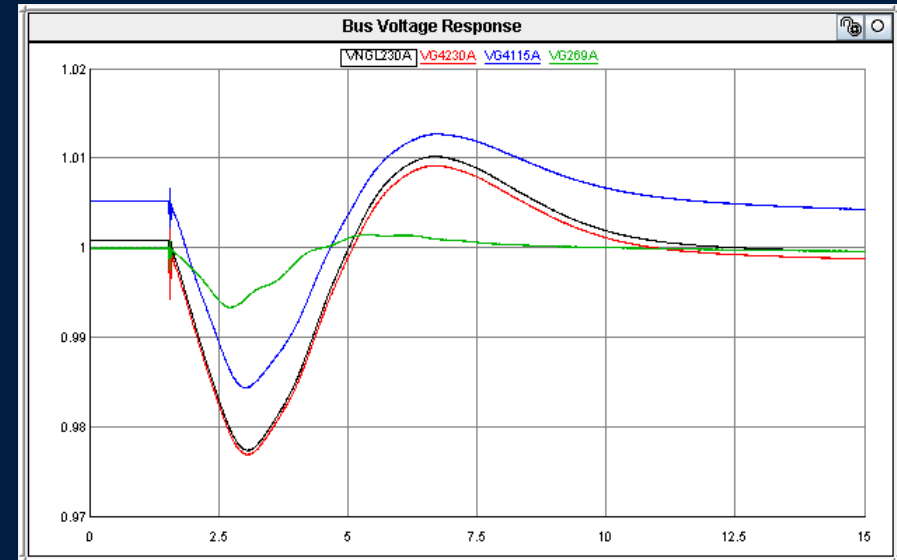
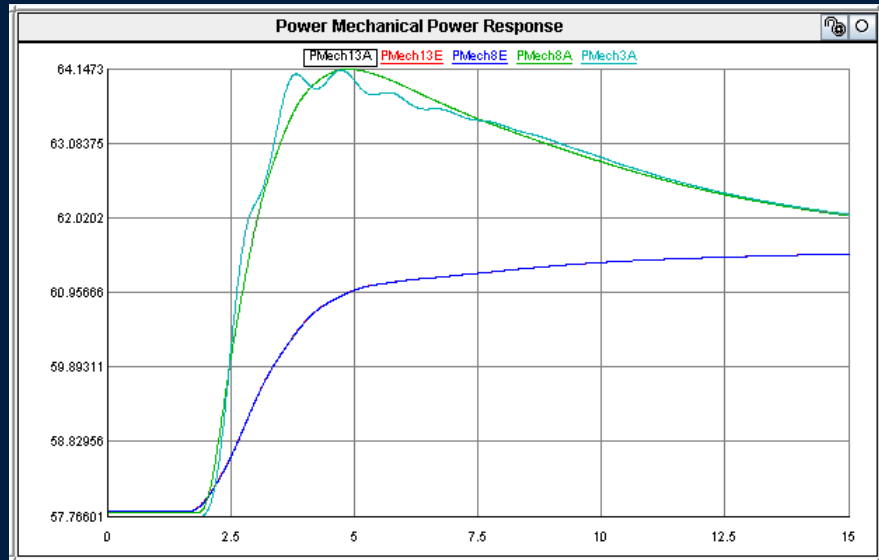


# Control Cost, Quality, and Features With HIL Testing

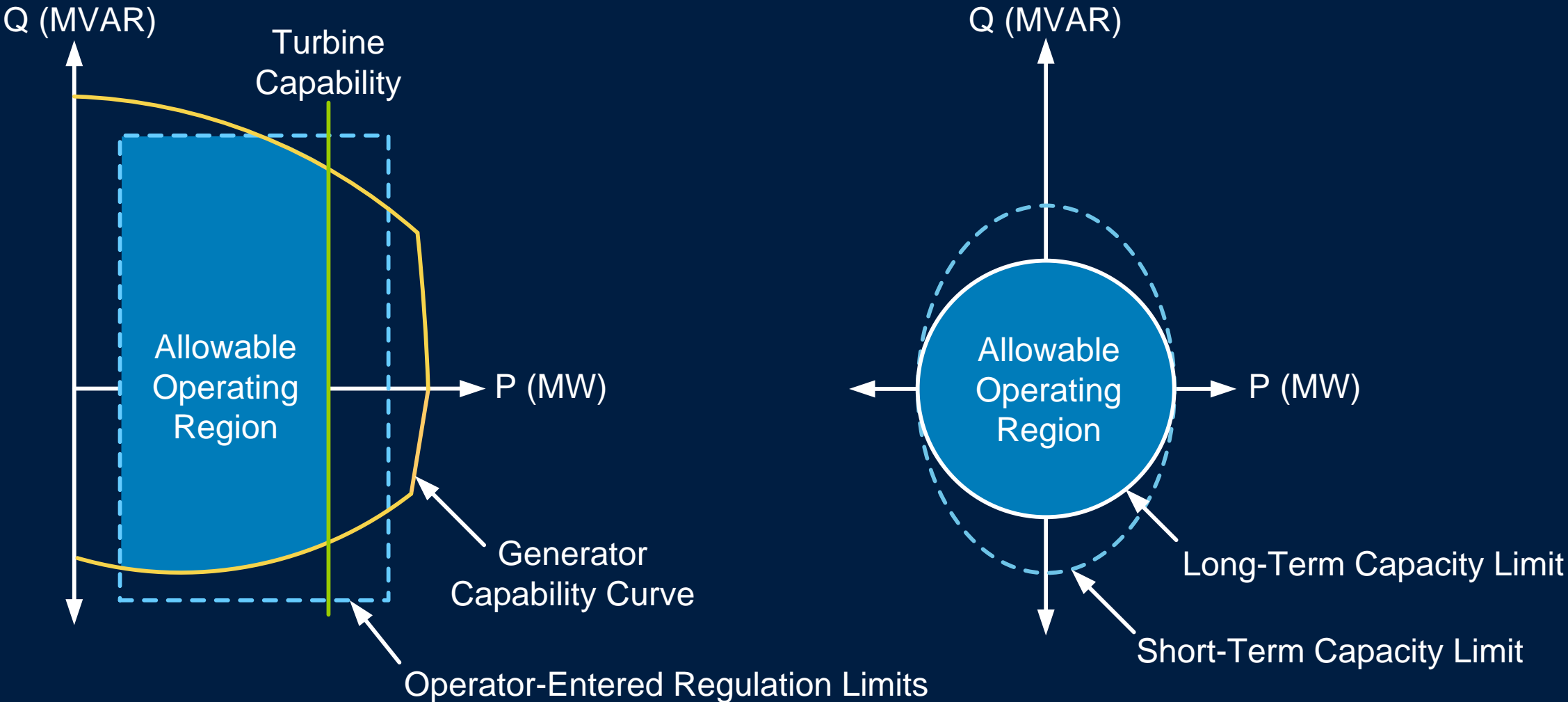


Both mechanical and electrical systems must be modeled accurately

# Real-Time Interaction – System Dynamics



# DER Capability Modeling



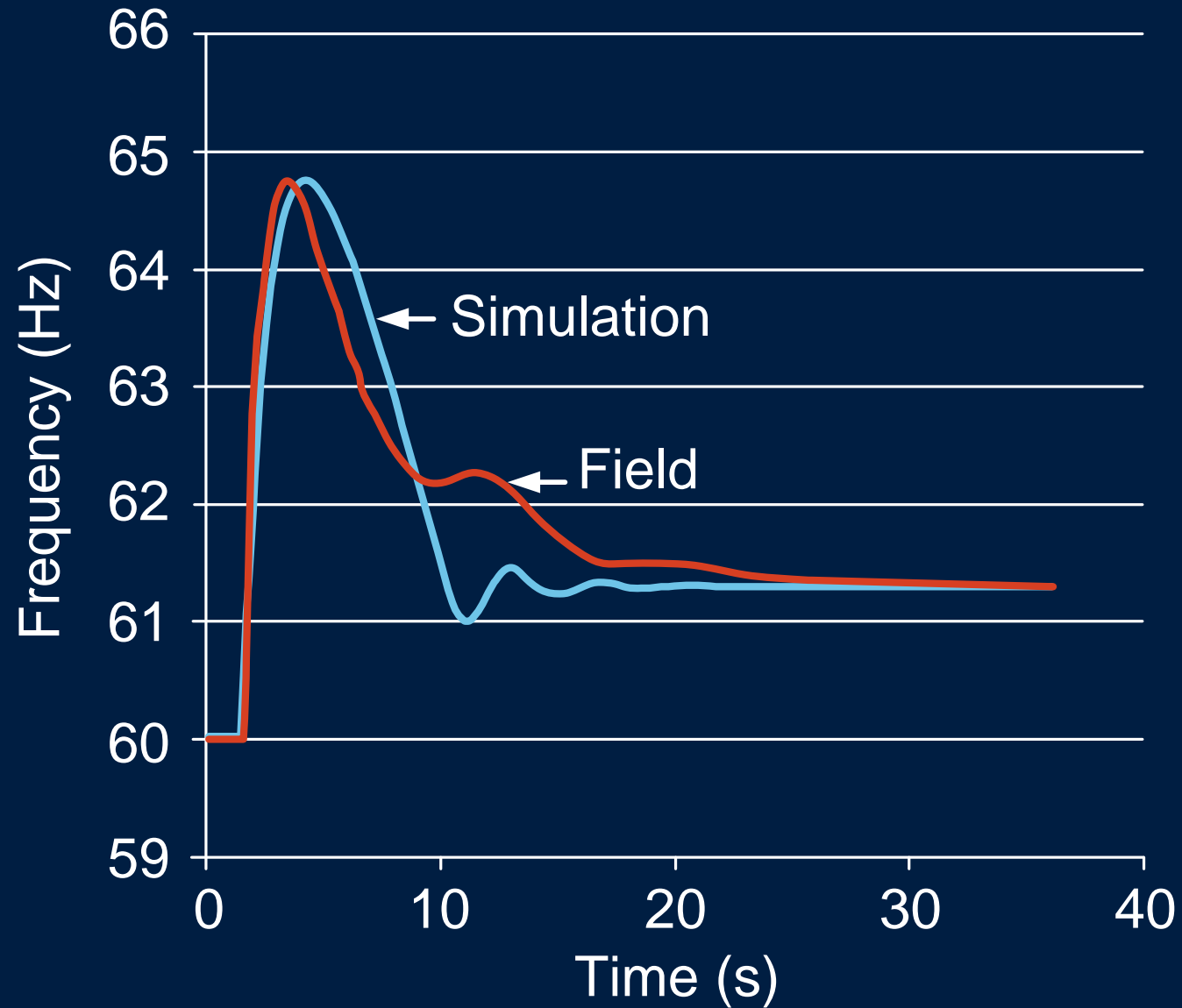
# Hardware-in-the-Loop Testing



SEL PMS Controller



# Fit for Function Modeling



# Factory Acceptance Testing

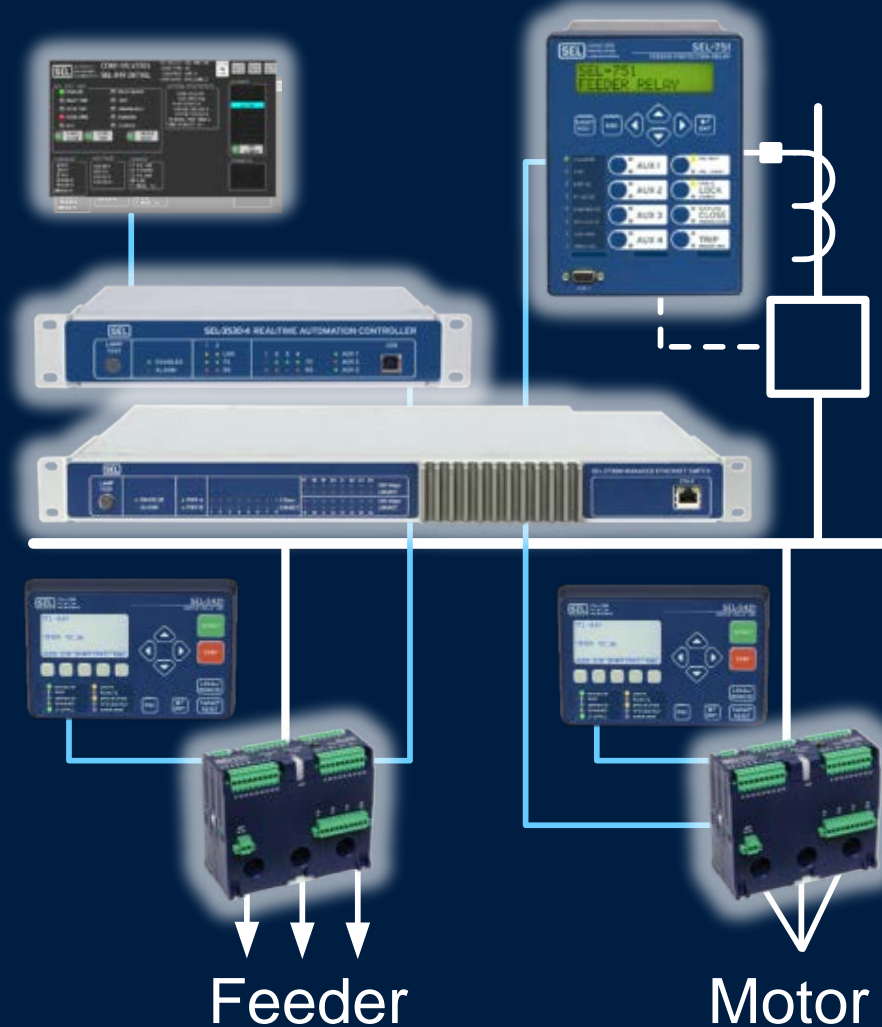


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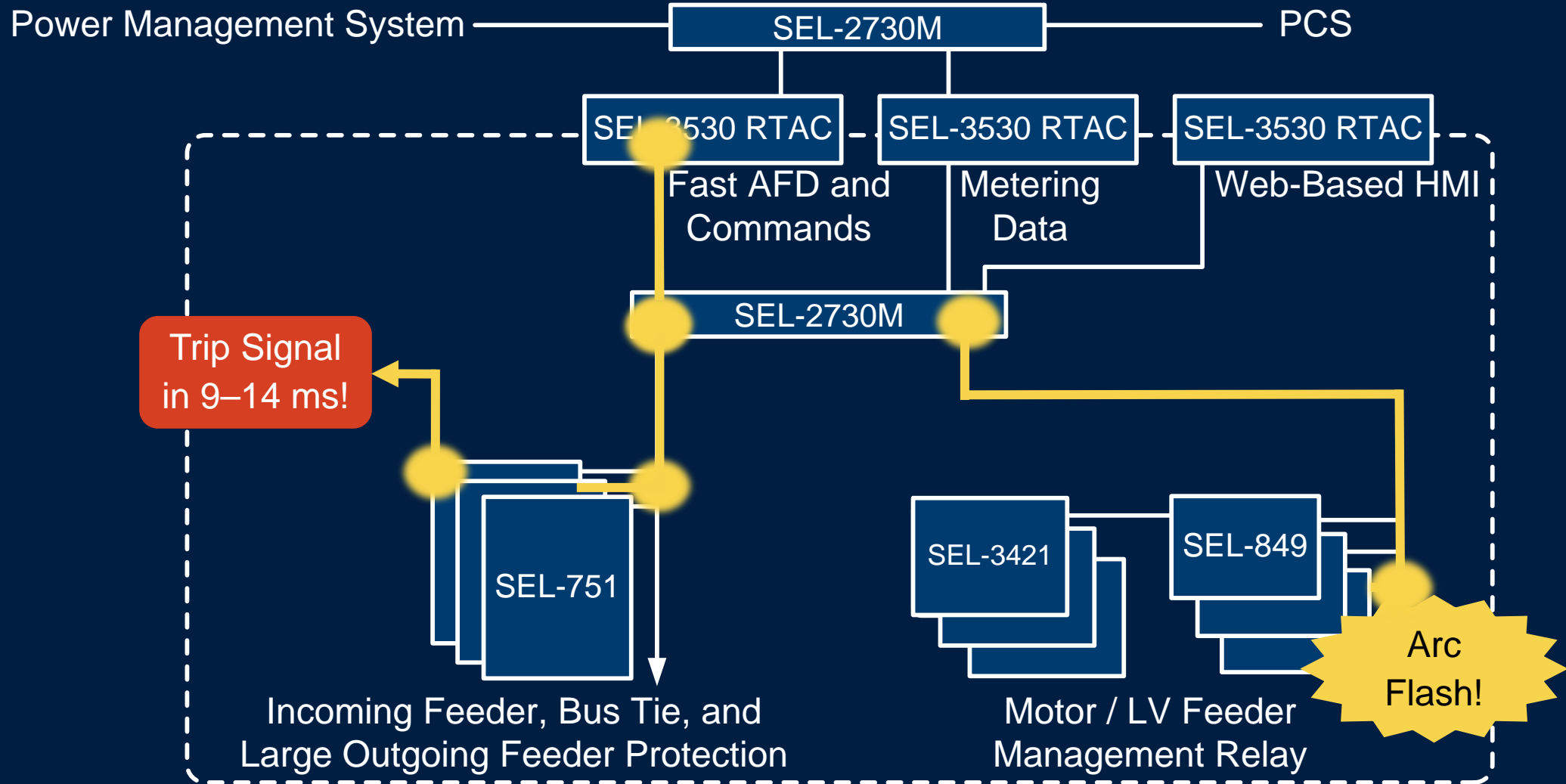
# SEL MOTORMAX™ Redefines LV Motor Management

- SEL protection
- Complete HMI
- Arc-flash protection
- Remote management
- Scales for any size MCC
- Engineering tools
- 100% factory tested!

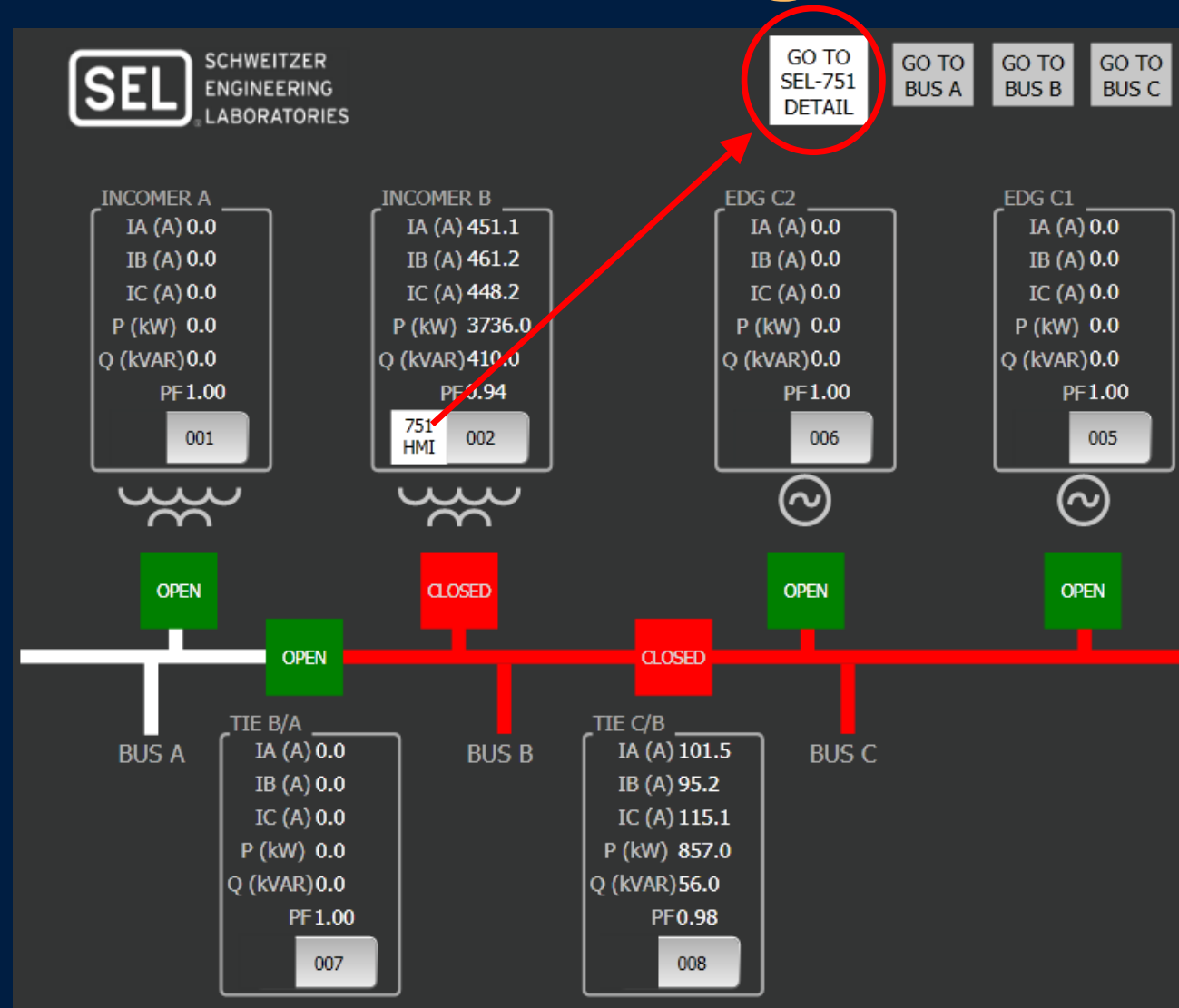




# Eliminate Hard Wiring With One Ethernet Cable



# 100% Situational Awareness With Intuitive One-Line Diagrams



# SEL-751 Detailed Pop-Up Screen Provides More Details



SEL DEVICE: SEL\_751\_002  
LOAD TYPE: 20  
LOCATION: B-01  
LOAD NAME: INCOMER B

GO TO  
ONE  
LINE

GO TO  
BUS A

GO TO  
BUS B

GO TO  
BUS C

SEL-751

- ENABLED
- TRIP
- CBCT TOC TRIP
- PHASE TOC TRIP
- AFD
- TRIP COIL OK
- CLOSE COIL OK
- ALARM

START/  
CLOSE

STOP/  
TRIP

TARGET  
RESET

CURRENT

- IA 451.1 A
- IB 461.2 A
- IC 448.2 A
- IG 6.25 A
- IN 1.56 A
- UBI 2.0 %

VOLTAGE

- VAB 481 V
- VBC 477 V
- VCA 483 V
- UBV 1.6 %

ALARMS

- TRIP COIL FAIL**
- CLOSE COIL FAIL
- SPRING CHARGE
- HW ALARM
- SW ALARM
- WARNING
- RACKED OUT
- MODBUS FAIL
- GOOSE FAIL

ACK  
ALARMS

SEL-787

- ENABLED
- TRIP
- DIFFERENTIAL
- INST. OC TRIP
- TIME OC TRIP
- GND. OC TRIP

MODBUS FAIL

POWER

- P 373.6 kW
- Q 41.0 kVAR
- S 382.2 kVA
- PF 0.94
- F 59.98 Hz

TARGETS

- ARC FLASH
- 46
- 51P
- 51G / 50N
- LOP

# Safely Manage Motors Remotely

The screenshot displays an HMI interface for motor management. At the top left, the logo for SEL SCHWEITZER ENGINEERING LABORATORIES is visible. The interface is divided into several sections:

- Navigation Buttons:** "GO TO SEL-849 DETAIL", "GO TO SEL-751 DETAIL", "GO TO ONE LINE", "GO TO BUS A", and "GO TO BUS B".
- Load Summary:** A grid of load status indicators. A callout box highlights the "SEL-849" load, which is currently "LOAD OFF" (indicated by a green box) and has a value of "017". Below this, it lists "C5F-08" and "59-HOLD-3.05".
- Schematic Diagram:** A detailed diagram of the bus system, showing various components like "ETHERNET SWITCHES", "EMPTY ПУСТОЙ", and "CABLE ENTRY POWER SUPPLY". A red circle highlights the "C5F" bus label at the top of the diagram, and another red circle highlights a specific component labeled "08" in the schematic.

A green text box on the right side of the interface states: "HMI bus views mimic MCC general arrangements".

# Summarizes Full SEL-849 Data Set



SEL DEVICE: SEL\_849\_014  
LOAD TYPE: 10  
LOCATION: C4F-14  
LOAD NAME: 59-HOLD-3.02

GO TO  
ONE  
LINE

GO TO  
BUS A

GO TO  
BUS B

GO TO  
BUS C

## SEL-3421 HMI

- ENABLED
- RELAY TRIP
- MCCB TRIP
- MCCB OPEN
- AFD
- RELAY ALARM
- TEST
- UNAVAILABLE
- RUNNING
- STOPPED

START/  
CLOSE

STOP/  
TRIP

TARGET  
RESET

## SEL-849 MOTOR DATA

LOAD xFLA 0.0  
RUN TIME 0 hr  
# OF STARTS 0  
STATOR TCU 0.0 %  
ROTOR TCU 0.0 %  
THERMAL TRIP 9999 s  
TIME TO RESET 0 s

## ALARMS

SIS TRIP  
PTC TRIP  
49  
27 / 59  
AUX. AC FAIL  
HW ALARM  
SW ALARM  
WARNING  
MODBUS FAIL  
GOOSE FAIL

ACK  
ALARMS

## CURRENT

IA 0.0 A  
IB 0.0 A  
IC 0.0 A  
IG 0.00 A  
IN 0.00 A  
UBI 0.0 %

## VOLTAGE

VAB 0 V  
VBC 2 V  
VCA 0 V  
UBV 0.0 %

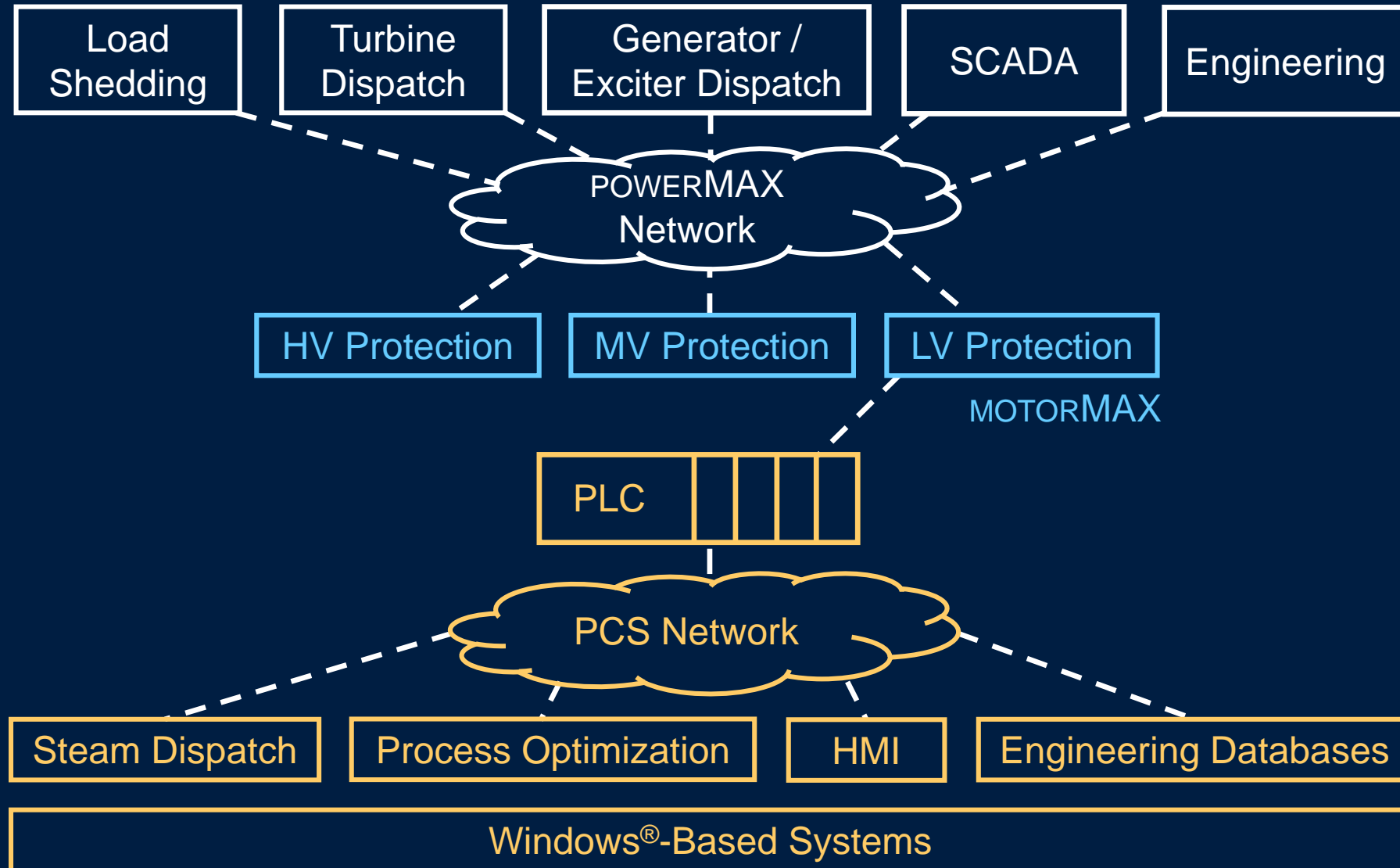
## POWER

P 0.0 KW  
Q 0.0 kVAR  
S 0.0 kVA  
PF 1.00  
F 60.00 Hz

## TARGETS

**ARC FLASH**  
46  
51P  
51G / 50N  
3421 COMM FAIL  
LOCAL MODE

# Linking Process Control to POWERMAX



# Questions?

